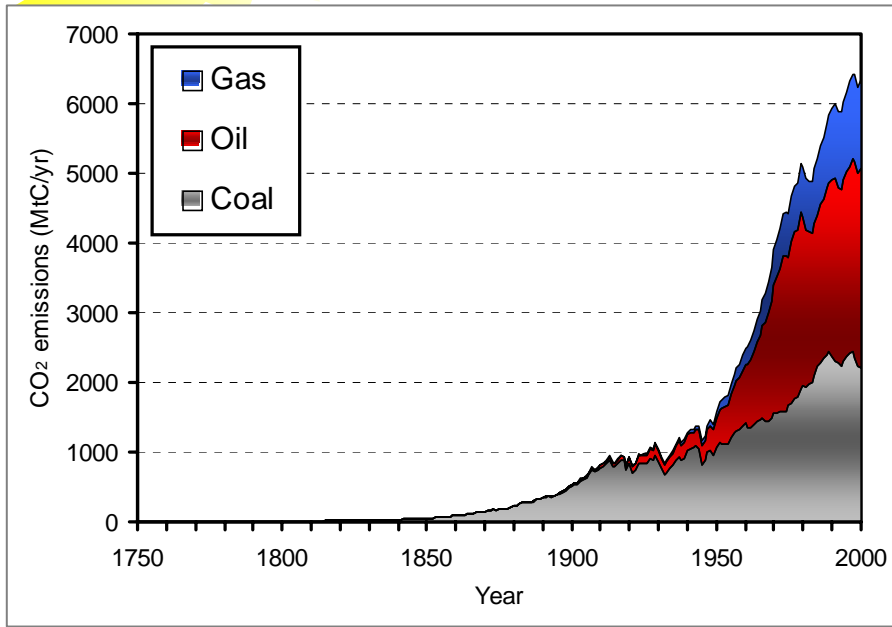

Global Warming

Cause , Impact and Mitigation



Cause of Global Warming

《Point》 Global warming is caused by anthropogenic activities.

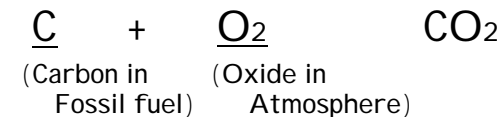


Source: Carbon Dioxide Information Analysis Center, ORNL

CO₂ Emission by fuel

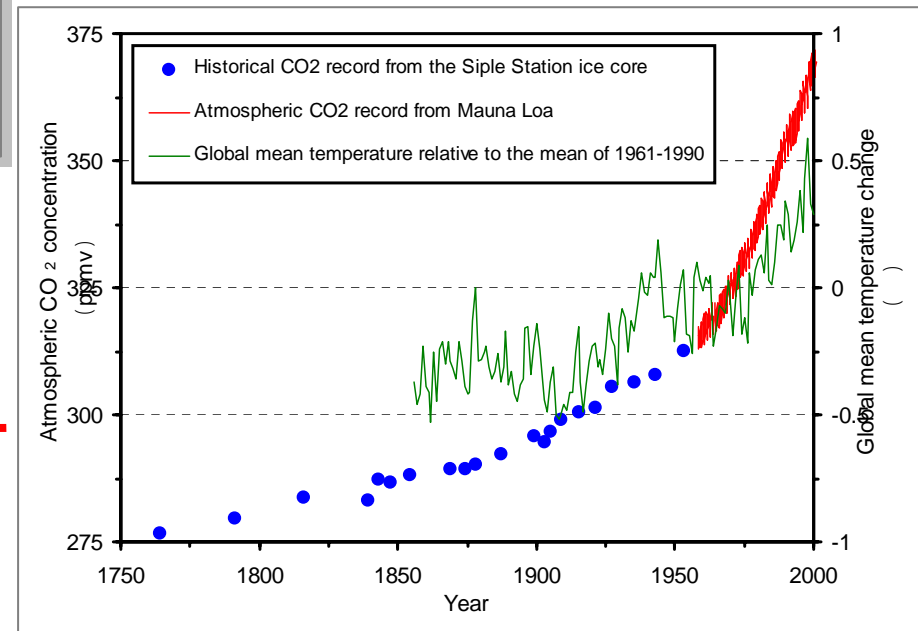
Fossil fuel consumption is increasing rapidly to satisfy growing energy demand after the Industrial Revolution, which started at the end of the 18th century.

Fossil fuel combustion :



Atmospheric CO₂ Concentration and Global mean Temperature

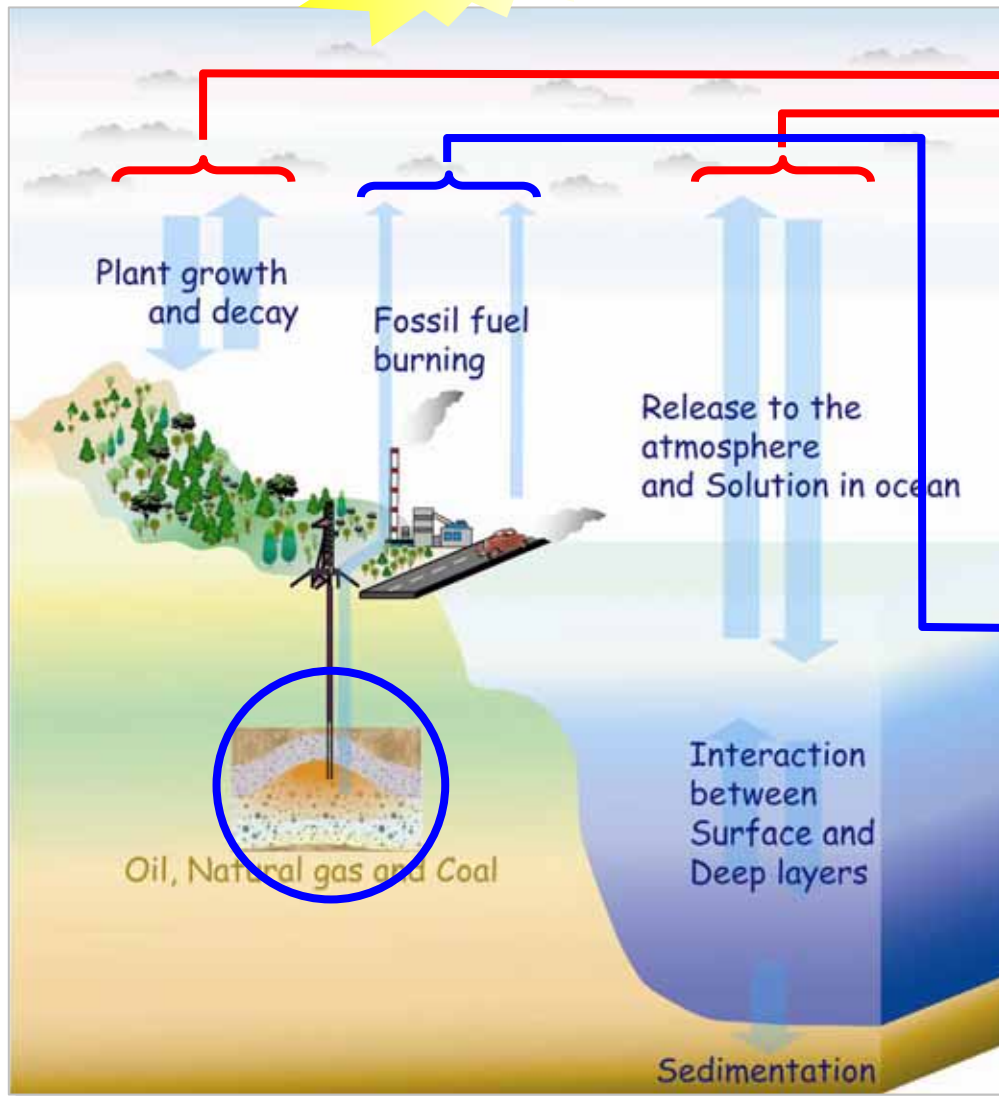
Atmospheric CO₂ concentration and global mean temperature increase with the rapid increase of CO₂ emission.



Source: Carbon Dioxide Information Analysis Center, ORNL

Carbon Cycle

《Point》 Carbon(C) circulates on the Earth.



The carbon (C) circulates among terrestrial plants, the atmosphere and the ocean, undergoing various reactions.

For example,

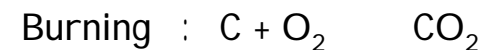
Solution



Photosynthesis



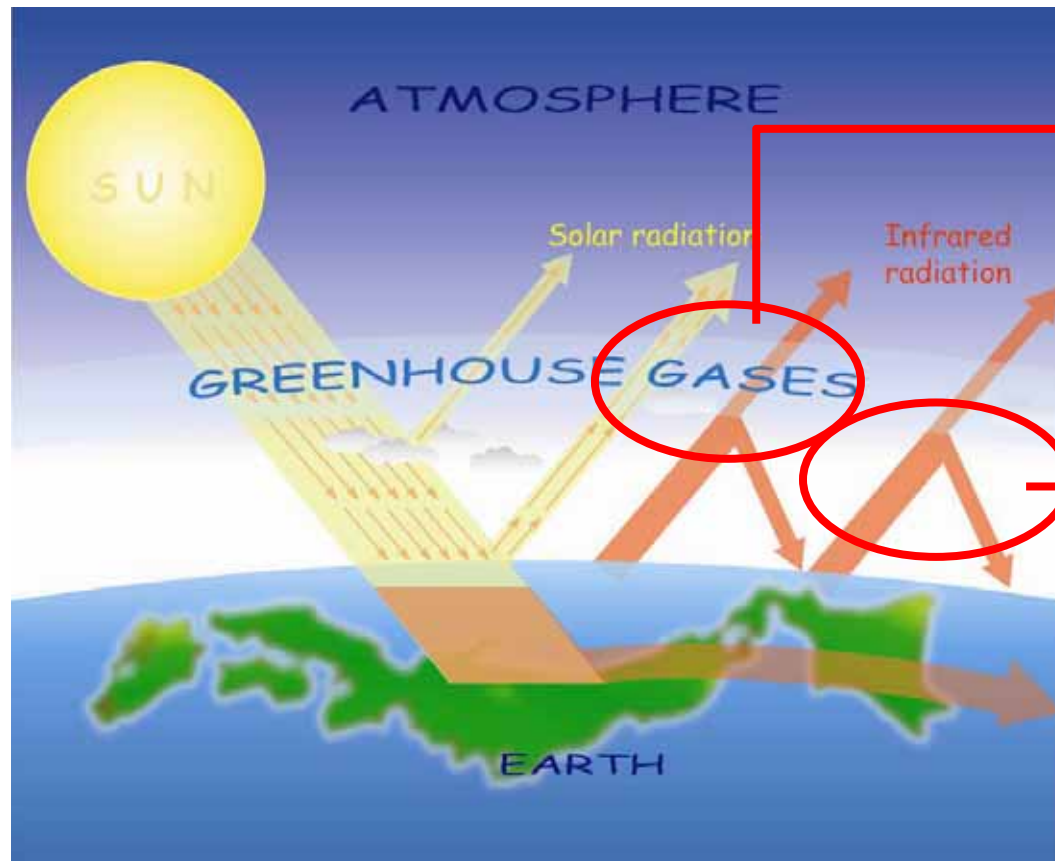
However, anthropogenic activities like fossil fuel burning and deforestation have released carbon (C) to the atmosphere and have increased the carbon in the atmosphere.



This carbon increase in the atmosphere leads to the global warming.

Greenhouse Effect

《Point》 CO₂ (carbon dioxide) plays an important role to keep the earth warm.

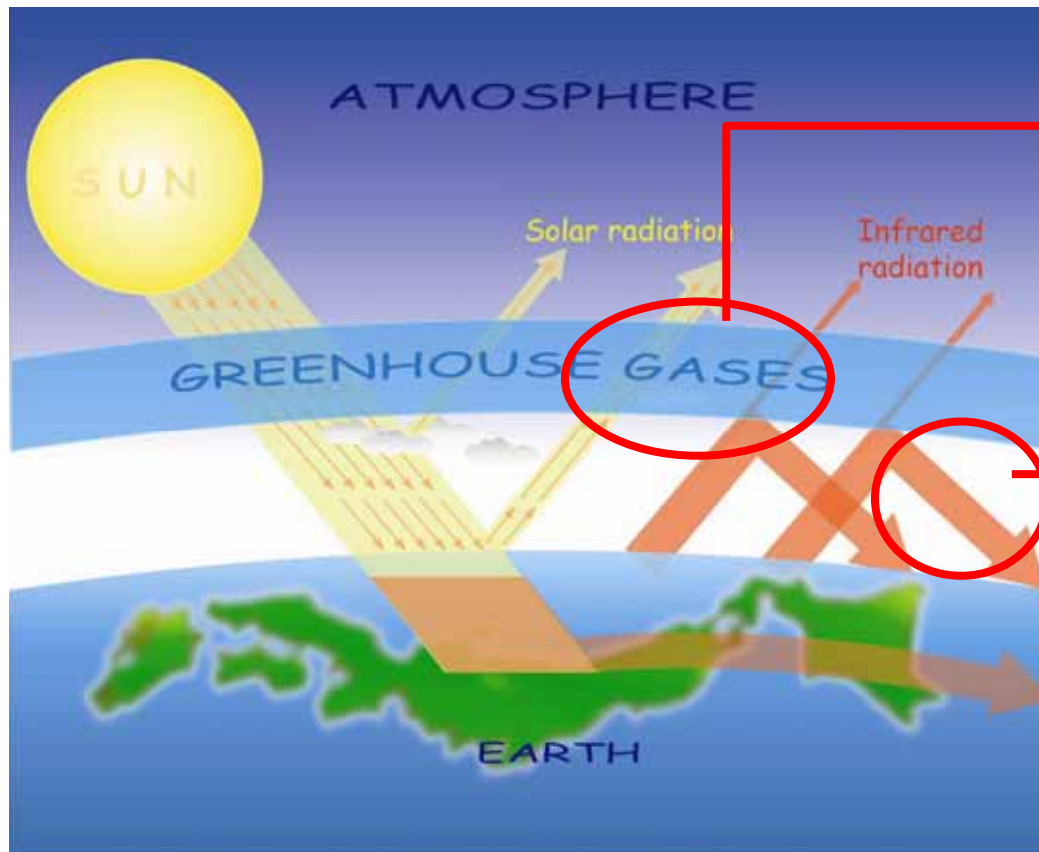


Greenhouse gases, e.g., CO₂, absorb infrared radiation, while solar radiation passes through gas layer.

Certain amounts of greenhouse gases (CO₂ etc) are necessary to keep the earth warm.

Global Warming

《Point》 However, increase in atmospheric concentration of CO₂ causes global warming.

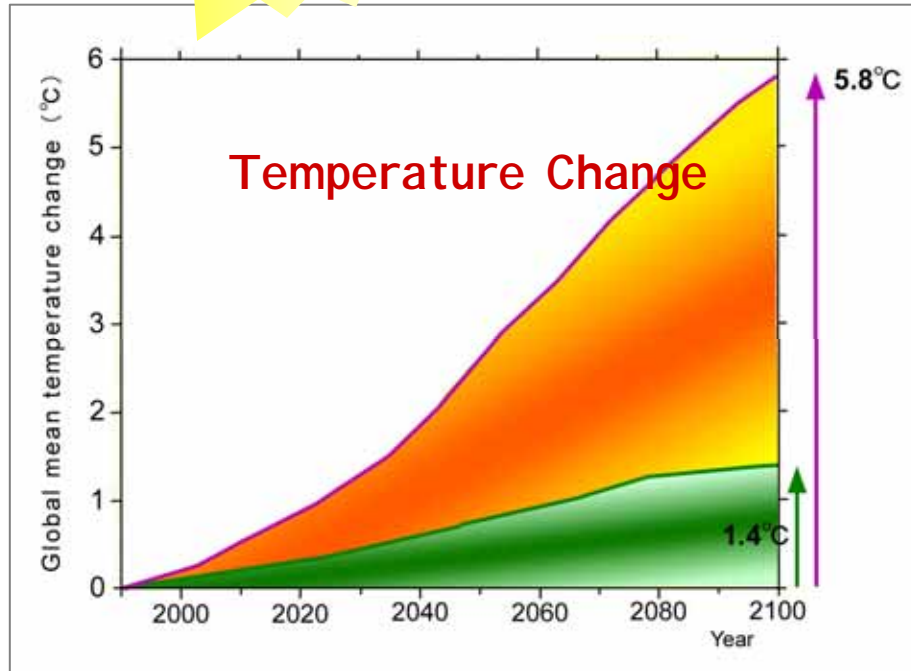


CO₂ increase in the atmosphere "thickens" the infrared radiation absorption layer.

The "thicker" absorption layer keeps the earth warmer.

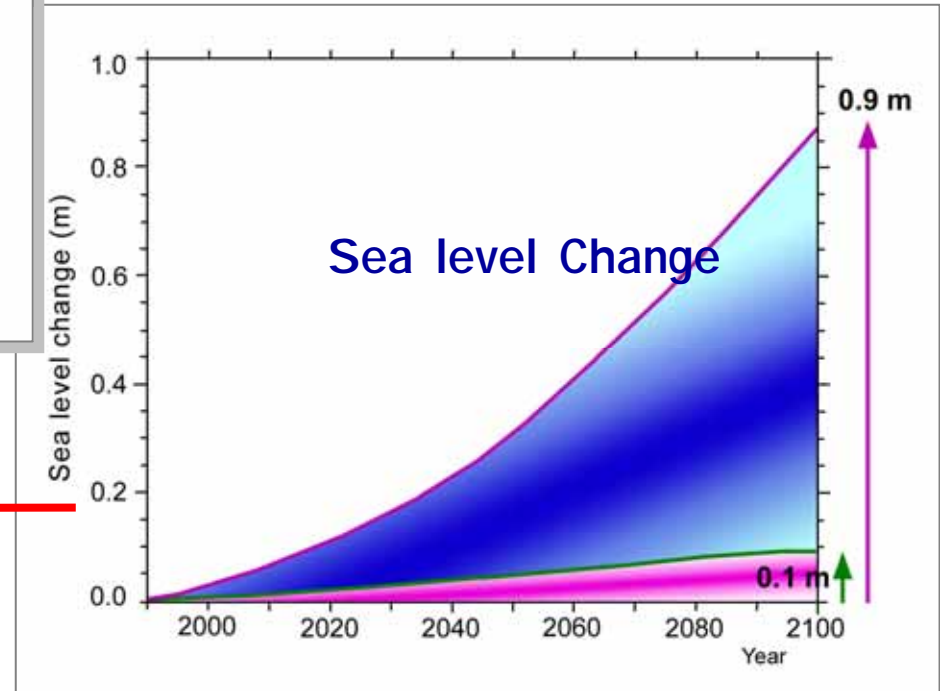
Projection of Climate Change

《Point》 CO₂ concentration increase causes the rises of the global temperature and sea level.



Temperature rise of 1.4 deg.C at the lowest and 5.8 deg.C at the highest is projected in case of no CO₂ emission reduction.

Source: The Third Assessment Report by Intergovernmental Panel on Climate Change(IPCC)

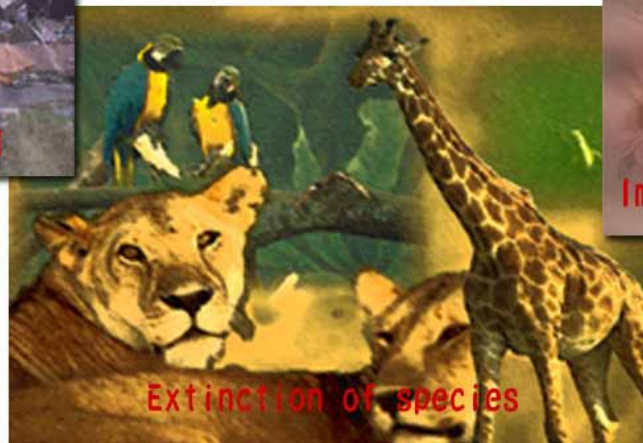
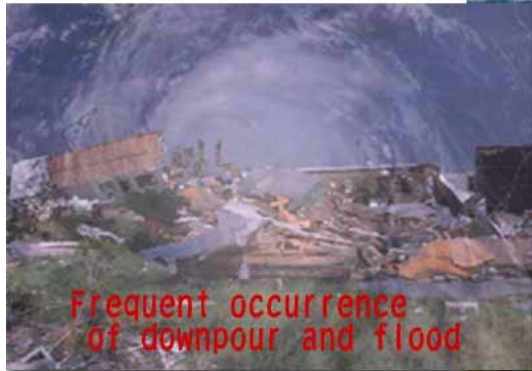
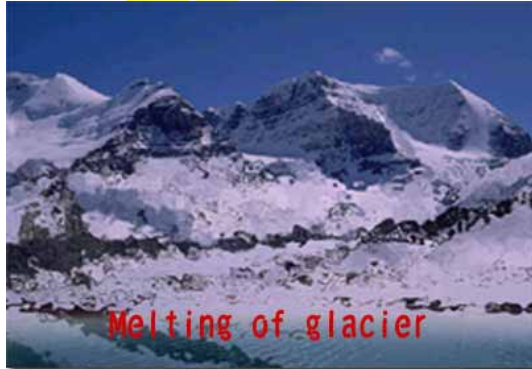


Sea level rise of 0.1m at the lowest and 0.9m at the highest is projected in case of no CO₂ emission reduction.

Source: The Third Assessment Report by Intergovernmental Panel on Climate Change(IPCC)

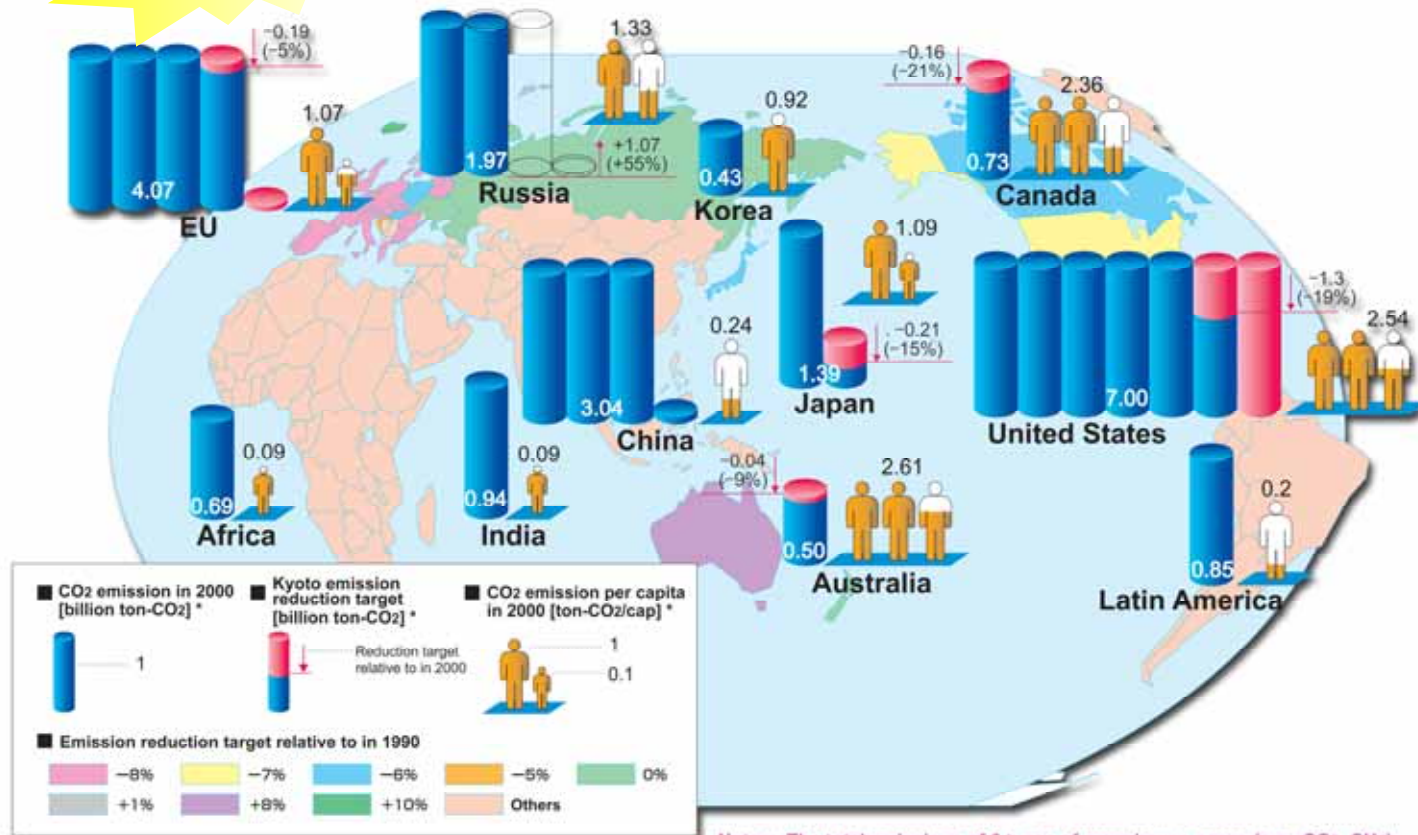
Global Warming Impacts

《Point》 Extraordinary weather is projected to occur in various world regions.



CO₂ Emission

《Point》 CO₂ emissions vary widely across countries.



Source) Estimated by RITE using data of UNFCCC and IEA

Notes: The total emissions of 6 types of greenhouse gases (e.g., CO₂, CH₄) are shown for the countries to comply with the emission reduction target of Kyoto protocol [equivalent of CO₂]. Only CO₂ emission from fuel combustion is shown for the other countries.

- CO₂ emissions and per capita emissions are large at present for developed countries.
- CO₂ emissions in developing countries are projected to increase with the population and the economic growths.

Global Warming Mitigation

CO2 emission reduction technologies

Energy Saving

Fuel Switching among Fossil Fuels

Fuel switching from coal to oil, from oil to natural gas, etc.

Nuclear Power

CO₂-free power generation

Renewable Energy

Hydro Power

Solar Heat

Photovoltaics Solar cells

Wind Power

Biomass Energy

Direct burning, conversion to gaseous fuels, or liquid fuels of biomass (e.g., wood residues, black liquor, kitchen wastes)

Photovoltaics



Wind power



《Point》

We have various mitigation options to reduce CO₂ emissions. A cost-effective combination of the options is required.

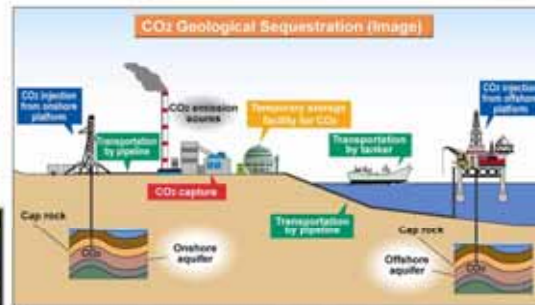
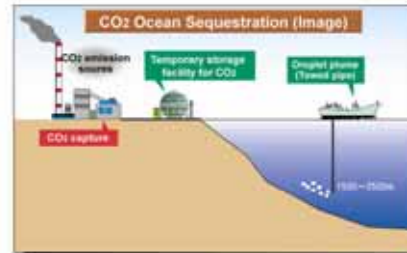
CO2 capture and sequestration

Ocean Sequestration

CO₂ sequestration into ocean by utilizing CO₂ solution capacity of ocean

Geological Sequestration

CO₂ sequestration into under-ground by utilizing geological features (e.g., aquifer, depleted gas well, oil well, coal bed)



Expansion of CO2 sink

Forestation, Greening of Deserts

Fixation of atmospheric CO₂ by photosynthesis of terrestrial plants



Global Warming Mitigation Scenario

《Point》 Economic consideration is important to select a combination of the options.

